



# Solar Sail Demonstration Project

## NASA's Technology Demonstration Missions Program

The solar sail — a huge, ultra-thin sail unfurling in space, using the pressure of sunlight to provide propellant-free transport — is an innovative alternative to conventional chemical propulsion systems, and one long in development by NASA and its partners.

Now a NASA research team is developing a Technology Demonstration Mission project known as “In-Space Demonstration of a Mission-Capable Solar Sail,” or the Solar Sail Demonstrator, which will prove the viability and value of solar sail technology.

Led by industry manufacturer L’Garde Inc. of Tustin, Calif., partnering with the National Oceanic and Atmospheric Administration and Space Services Inc., the Solar Sail Demonstrator builds on two successful ground-deployment experiments led by L’Garde in 2005-2006 in a vacuum chamber at the Plum Brook Facility in Sandusky, Ohio, a research laboratory managed by NASA’s Glenn Research Center in Cleveland. It also leverages the successful deployment of

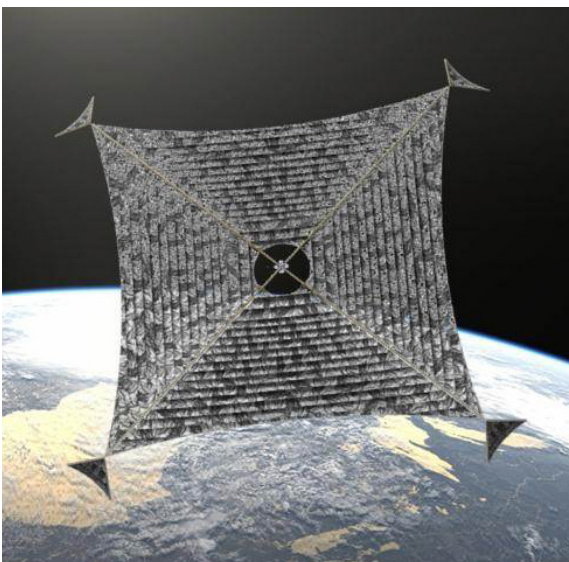
the NanoSail-D2 sail, a 100-square-foot test article NASA launched to Earth orbit in early 2011 to validate sail deployment techniques.

During its test flight set for fall 2014, the new Solar Sail Demonstrator — dubbed “Sunjammer” by its designers in honor of the 1964 Arthur C. Clarke story of the same name, in which he coined the term “solar sailing” — will deploy and operate a sail approximately 124 feet on a side. That’s almost 13,000 square feet, or a third of an acre — seven times larger than any solar sail tested in space to date. But when collapsed, the test sail is the size of a dishwasher and weighs just 70 pounds.

Attached to a 175-pound disposable support module, the Sunjammer is designed to be efficiently packed into a secondary payload on a rocket bound for low-Earth orbit.

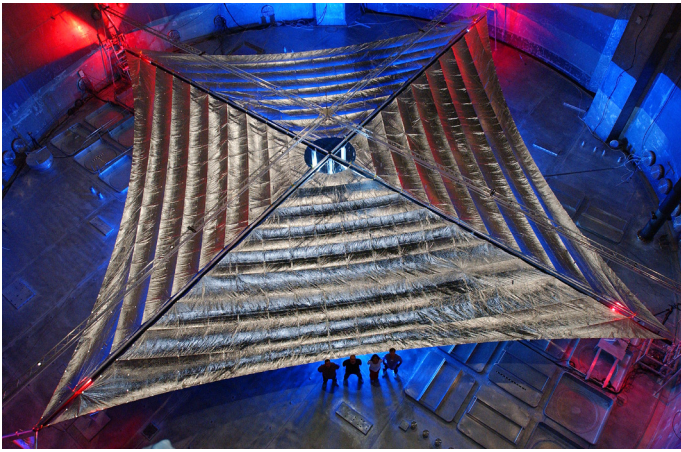
The sail will unfurl in space to catch the sunlight. During the flight experiment, researchers will study the ability of the sail’s beam-tip vanes to provide attitude stabilization and control; determine the vehicle’s ability to trim, or set its sail’s angle relative to the solar wind; and execute a navigation sequence based on typical mission requirements.

Once proven, solar sail technology could enable a host of versatile space missions, including flying an advanced space-weather warning system to more quickly and accurately alert satellite operators and utility companies on Earth of geomagnetic storms caused by coronal mass ejections from the sun. The technology also could provide an economical solution to removing some of the more than 8,000 pieces of orbital launch debris ringing the planet; hover at high orbital latitudes above Earth for communications and observation missions; and drive a variety of propellantless, deep-space exploration and supply ferrying missions.



**An artist's rendering of the Solar Sail Demonstration project in flight. (L’Garde)**

NASAfacts



A 98-foot sail test article underwent deployment testing in 2005-2006 at NASA's Plum Brook Facility in Sandusky, Ohio. (NASA/GRC)

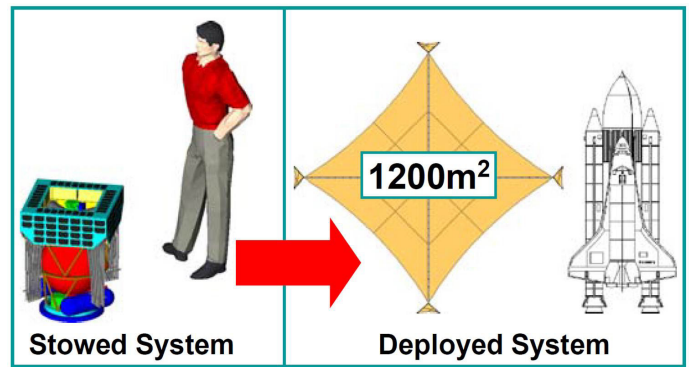
The Solar Sail Demonstrator project successfully held its Preliminary Design Review in fall 2012. Its next major milestone, the Critical Design Review, is planned for fall 2013. The demonstrator will launch on a Falcon 9 rocket as early as fall 2014.

### More About NASA's Technology Demonstration Missions Program

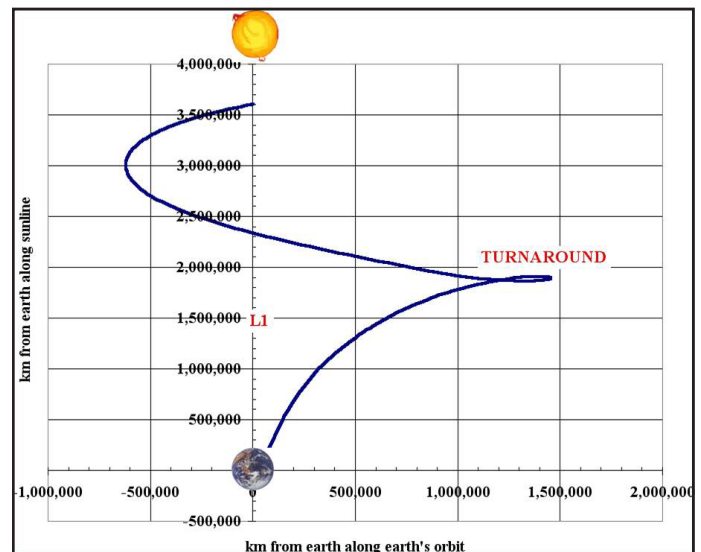
The Technology Demonstration Missions Program is charged with proving revolutionary, crosscutting technologies — ones that could radically advance NASA's mission in space and reap untold benefits for science and industry here on Earth. Reporting to NASA's Space Technology Mission Directorate in Washington and managed for the agency by NASA's Marshall Space Flight Center in Huntsville, Ala., the program includes cutting-edge research and development projects at NASA field centers and partner facilities around the nation.

#### Demonstration Objectives

- Demonstrate segmented deployment of a solar sail
- Demonstrate attitude control plus stability and trim using beam-tip vanes
- Execute a navigation sequence with mission-capable accuracy
- Fly to and possibly maintain position at L1 and/or "polesitter" positions



The Solar Sail Demonstrator, dubbed "Sunjammer," is shown in its stowed configuration and in its fully deployed configuration in relation to well-known references. (L'Garde)



The Solar Sail Demonstrator's ultimate destination will be the sub-L1 position between Earth and the sun, where the Sunjammer is expected to provide solar storm warnings earlier than existing L1 solar monitoring probes.

National Aeronautics and Space Administration

George C. Marshall Space Flight Center

Huntsville, AL 35812

[www.nasa.gov/marshall](http://www.nasa.gov/marshall)

[www.nasa.gov](http://www.nasa.gov)